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CORN EARWORM CONTROL— TIMING AND NUMBER OF APPLICATIONS[1]

WALTER H. THAMES, JR.[2]

The ears of sweet corn require about eighteen to twenty-two days to mature from the time the first silks appear, based on observations of variety trials planted in March at Belle Glade, Florida. This period may be slightly longer or shorter, depending on the variety, cultural conditions, temperature during growth, time of planting, and area in which planted.

Sweet corn must be protected with insecticides for a part of this maturation period in order to obtain a high percentage of ears free from infestation by the corn earworm, *Heliothis armigera* (Hbn.). Throughout most of the year, with the exception of winter and early spring, DDT-mineral oil emulsions are the most effective insecticides, but there is evidence that these mixtures reduce yield. For this reason, as well as to reduce the likelihood of a residue problem and lower the cost, it is desirable to know the minimum number of applications required for effective control.

The following report of a trial conducted at Everglades Experiment Station in May, 1951, gives some information on control of corn earworms obtained by: (a) increasing the number of applications from three to six; (b) initiating a series of applications on the third, fifth, seventh and ninth days after the first ears are in silk; and (c) varying the interval between applications in a series from forty-eight to seventy-two hours.

In this trial Ioana sweet corn was planted in five blocks of forty-eight four-row plots. The corn was thinned to twelve inches. A DDT-mineral oil emulsion was prepared by mixing three quarts of 25 percent DDT emulsion with 2.5 gallons of a white mineral oil (Blandol) to which water was added to make fifty gallons. This insecticide was applied with a compression type sprayer fitted with a No. 6501 TeeJet nozzle to each side of the center two rows of the plots. The rate of application was fifty gallons per acre and the pressure was 60 pounds per square inch. The nozzle was held about nine inches above the top ears

[1] Florida Agricultural Experiment Station Journal Series, No. 57. Spraying methods were discussed by J. W. Wilson in No. 20 of the Journal Series, in Florida Entomologist, XXXV(1): 3-9, 1952.

[2] Assistant Entomologist, Everglades Experiment Station, Belle Glade, Florida.

TABLE NO. 1.—CORN EARWORM CONTROL, EVERGLADES EXPERIMENT STATION, MAY, 1951. PERCENT WORM FREE EARS, NUMBER OF APPLICATIONS, INTERVAL BETWEEN APPLICATIONS, DAYS IN SILK WHEN APPLICATIONS WERE STARTED AND STOPPED, AND THE AVERAGE YIELD FOR EACH TREATMENT ARE SHOWN. MATERIAL APPLIED IS DDT-OIL UNLESS OTHERWISE INDICATED.

Treatment	No. of Applications	Interval Between Applications	Days After 1st Silks When Started	When Stopped	Percent Worm-Free Ears	Average Yield in Pounds
1.	6	48 hours	3	13	96	37.7
2.	6	48	5	15	68	35.15
3.	6	48	7	17	39	37.9
4.	6	48	9	19	37	35.75
5.	5	48	3	11	92	37.25
6.	5	48	5	13	65	38.85
7.	5	48	7	15	55	37.05
8.	5	48	9	17	20	39.6
9.	5	72	3	15	83	38.35
10.	5	72	5	17	68	36.15
11.	5	72	7	19	50	37.55
12.	4	48	3	9	70	38.45
13.	4	48	5	11	79	36.35
14.	4	48	7	13	47	36.4
15.	4	48	9	15	18	38.9
16.	4	72	2	11	87	34.7
17.	4	72	5	14	63	39.2
18.	4	72	7	16	41	35.45
19.	4	72	9	18	15	35.45
20.	3	48	3	7	47	36.7
21.	3	48	5	9	55	36.75
22.	3	48	9	13	30	38.7
23.	3	72	3	9	70	39.05
24.	3	72	7	13	43	40.55
25.	3	72	9	15	19	38.7
26.	5	24	3	7	65	35.95
27.	4	24	3	6	45	40.85
28.	3	24	3	5	43	38.7
29.	2	24	2	3	0	37.7
30.	2	72	3	6	44	41.75
31. 5% DDT dust	6	48	3	13	37	40.85
32. 5% DDT dust	6	72	3	18	20	42.20
33. No treatment		—	–	—	0	36.70
			L.S.D. at 19:1		20.4	
			at 99:1		27.2	

of the stalks with the spray directed towards the ears at an angle of about forty-five degrees. The effectiveness of the DDT-mineral oil emulsion was compared with no treatment and with six applications of a 5 percent DDT dust at 35 pounds per acre, applied by hand with a rotary duster.

Results of each treatment were compared on the basis of the average percent of worm-free ears from a sample of twenty top ears harvested at random from each of the five blocks. Possible effects of number of applications on yield were determined by comparing average yield in pounds for each of the treatments.

The number of applications, time with relation to silking that a series of applications was started, and intervals between applications are shown in the table, together with percent worm-free ears and yield for each treatment. Some treatments, for which applications could not be made according to schedule, are omitted. All treatments were used in calculating the confidence limits shown.

The infestation of corn earworms was uniform and severe for the period of this trial, as shown by counts of eggs on silks of one hundred ears. This number increased from sixty eggs on 100 ears on May 11 to 190 eggs by May 18.

DISCUSSION OF RESULTS: A higher percentage of worm-free ears was obtained when the corn was protected to the twelfth day after silking. There was no significant difference in worm-free ears between four applications made at seventy-two hour intervals and six applications made at forty-eight hour intervals provided the series of applications was started on the third day after the first silks appeared in the trial.

The forty-eight hour interval appeared superior to the seventy-two hour interval when five applications were made, but the extended period of protection provided by the seventy-two hour interval resulted in better control when three or four applications were made.

Two factors were observed to introduce error in the results. The most important of these was uniformity of silking. Plots in which most of the ears were in silk by the second application showed a higher percentage of worm-free ears than those in which the ears developed silks slowly. The other factor was the variation in the number of ears with leaves in a position that deflected all or a part of the spray away from the silks. In one plot over 12 percent of the ears were partially covered by a leaf.

The yield in pounds of corn per acre was not significantly

affected by the number of applications in this trial, although highest yields were obtained with the dust applications.

Dust applications are not effective in controlling corn earworms when the infestation is moderate to severe.

It is concluded that a series of five applications of the DDT-mineral oil emulsion used in this trial, applied at two-day intervals starting as soon as the first silks are seen in the field, will give a high percentage of worm-free ears.

BOOK NOTICE

HANDBOOK OF TURTLES. THE TURTLES OF THE UNITED STATES, CANADA, AND BAJA CALIFORNIA, by Archie Carr. xv + 542 pages, 37 figures, 82 plates, 15 tables. 1952. Comstock Publishing Associates, Ithaca. Price $7.50.

Although a book about turtles is far removed from the primary interests of entomologists, it was felt that a notice of its publication would be a service to the members of the Florida Entomological Society. This outstanding work, written by Professor Carr, Department of Biology, University of Florida, is a monument to his perseverence over many years.

Seventy-nine species and subspecies of turtles that inhabit the United States, Canada, and Lower California are treated in considerable detail. Though some may think that turtles are prosaic creatures, Dr. Carr soars to heights of rhetoric in describing their evolutionary history. "They [turtles] remained unimpressed as *Pteranodon* cruised the skies and another strain of slim and athletic archosaurs devised Archaeopteryx and the birds, and as the Squamata dabbled in mososaurs and snakes. They remained turtles; they even began to prosper as never before, while the dinosaurs bellowed and pounded down through the Jura toward their utter and senseless doom in the Cretaceous, when the last *Brachiosaurus* laid down his fifty tons to rest and the final tyrannosaur gasped out the anticlimax to nature's greatest venture in mayhem. . . ."

The turtles are discussed in general in Part I, the introduction. Part II gives accounts of the species, including keys. For each species there is a discussion of the range, distinguishing features, description, discussion of habitat and habits, breeding data, feeding habits, and economic importance.

The book is excellently written, well printed, illustrations and photographs clear, and the distribution of each species is mapped. *Handbook of Turtles* should be on the bookshelf of all zoologists interested in the field of natural history.—L. B.

CORN EARWORM CONTROL—FORMULATIONS [1]

NORMAN C. HAYSLIP [2]

In the spring of 1948 six treatments of 2.7% DDT in an agricultural oil base were sprayed on the silks of sweet corn. Although some damage to pollination resulted from this treatment, 100% worm-free ears were produced as compared to 39% for DDT dust and 1% for the untreated check. An exhaustive study followed this experiment in an attempt to eliminate pollination and yield damage without sacrificing the excellent control obtained. At the end of these trials, however, it was concluded that oil solutions of DDT were not safe enough for a general recommendation.

Blanchard, in 1949, reported that DDT and oil emulsified in water, while not quite as effective as oil solutions, could be used without causing pollination damage. Experiments conducted in the spring of 1949 confirmed Blanchard's findings by reducing pollination injury significantly. A continuation of the work with emulsions in fall, 1949, and spring, 1950, indicated that every ingredient going into the spray formula was important from the standpoint of control, phytotoxicity and yield. In some (but not all) experiments yield reductions resulted where the DDT-mineral oil emulsions were used. Two formulations were found to cause phytotoxicity, and the degree of injury varied between varieties. The specifications of the mineral oils used seemed to influence the control obtained. With these factors to consider it was decided that future studies and recommendations must be made on complete formulations, taking into consideration the insecticide, solvent, emulsifier, oil and water. It appears that a fungicide must also be considered in the formulation, as well as certain nutrients applied as foliage sprays. The job seems to be to find the most suitable of each ingredient from the standpoint of effectiveness, compatibility, phytotoxicity, odor, flavor and residue remaining in and on the ears, and to determine the optimum amounts of each ingredient.

The corn earworm spray formulation trial, conducted in the late spring of 1951 at Fort Pierce, Florida, during a very severe

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[1] Presented at the Florida Entomological Society, Winter Haven, Florida, September 13-14, 1951. Florida Agricultural Experiment Station Journal Series, No. 58.

[2] Associate Entomologist, Everglades Experiment Station, Indian River Field Laboratory, Ft. Pierce, Florida.

corn earworm infestation, has supplied some interesting data, and a report of this experiment follows.

On March 26 a planting of Ioana sweet corn was made for the purpose of conducting corn earworm spray formulation studies. The corn was planted in rows 42 inches apart, and the plants were thinned to about 12 inches in the row.

Regular spray treatments of DDT emulsion were made for the control of budworms, and several zineb treatments were made for the control of *Helminthosporium* prior to the beginning of the regular earworm treatments. Early rains necessitated the foliar application of nitrate of potash, and manganese and zinc were applied as sprays on two occasions.

TABLE 1.—CORN EARWORM FORMULATION TRIAL, SPRING, 1951.

Plot No.	Treatments: DDT Formula/Amt. per Acre	Type Oil Used*/Amt. per Acre
1	5% DDT dust/35 lbs.	————
2	Check, not treated	————
3	25% Standard**/3 qts	None
4	25% Standard/3 qts.	Blandol/1.25 gals.
5	25% Standard/3 qts.	Blandol/2.50 gals.
6	25% Standard/2 qts.	Blandol/2.50 gals.
7	25% Standard/4 qts.	Blandol/2.50 gals.
8	25% Standard/3 qts.	Shell Helix Superior Oil/2.50 gals.
9	25% Standard/3 qts.	Shell Helix (7 parts) plus Shell Hort. Base #7 (3 parts)/2.50 gals.
10	25% Standard/3 qts.	Shell Hort. Base #7/2.50 gals.
11	25% Standard/3 qts.	Texaco Corvus Oil/2.50 gals.
12	Tech. DDT ..... 25% Sonn. Emul. "A" .. 15% Xylene ..... 60% /3 qts.	Blandol/2.50 gals.
13	Tech. DDT ..... 25% Sonn. Emul. "B" .. 15% Xylene ..... 60% /3 qts.	Blandol/2.50 gals.
14	Tech. DDT ..... 25% Triton X-155 ..... 5% Propylene Dichl. .. 70% /3 qts.	Blandol/2.50 gals.

* Blandol-White mineral oil, U.S.P., Visc. 90° to 95° Saybolt, Texaco Corvus Oil—Visc. 72°, not U.S.P. Shell Helix Superior Mineral Oil—103 Viscosity; Shell Horticultural Base Oil 7—Visc. Not known—probably about 50°.

** Standard DDT: Tech. DDT—25 percent; Triton X-155—5 percent; Xylene—70 percent.

After suffering from excessive rains while young, the corn recovered and produced a good crop. *Helminthosporium* and corn rust occurred in very mild form; fall armyworms were moderate to severe; corn-silk flies were light to moderate, and corn earworms were extremely abundant, with untreated ears containing an average of about three worms per ear.

There were 13 treatments and an untreated check replicated five times. Each plot consisted of two rows 30 feet long, with an untreated buffer row separating them. Three-foot alley-ways were provided between plots perpendicular to the rows. A list of treatments appears in Table 1.

The dust was applied at two-day intervals at the rate of 35 pounds per acre with a rotary-type hand duster which was directed to release the dust in the silking zone from each side of the row. Nine treatments were made, beginning when about 10 percent of the silks were showing. The applications were made early in the morning when the air was calm.

The sprays were applied at the rate of 50 gallons per acre with compression-type knapsack sprayers equipped with pressure gauges. A 95-degree angle fan spray nozzle was held slightly above the silking line spraying down onto the silks from each side of the row as the operator walked down one side and back the other at a predetermined speed to deliver the proper dosage. The first treatment was made when about 10 percent of the silks were showing. Three additional applications were made at three-day intervals, except that four days elapsed between the third and fourth treatments.

In order to determine the degree of the infestation, and at what time maximum egg deposition occurred, egg counts were made during the period of treatments. It was found that rather heavy egg deposition occurred throughout the silking period, and that quite a number of eggs were deposited on the husks and stalks near the ear tips.

Twenty primary ears were taken at random from each plot for examination in the laboratory. These ears were examined for husk color and burn, unhusked weight, number with corn earworm damage and tip development. The balance of the corn was harvested for total number of ears, total weight of ears, number of ears 6 inches or longer, and weight of ears 6 inches or longer. After harvest the plots were scored by three independent workers for degree of yellowing of the leaves.

Table 2 includes a summary of the more important data ob-

TABLE 2.—CORN EARWORM FORMULATION TRIALS.
Spring 1951

Plot No.	Treatment*	% Worm Free	% with Over 1½" of Tip Un-filled	Yellow-ing of Plants (Score)**	Wt. of Ears 6" or Over (Lbs.)	No. of 36 Lb. Crates per Acre
1	DDT dust—5%	0	1	1.80	257.5	293.3
2	Not treated	0	0	2.07	245.7	279.9
3	Standard emulsion—3 qts.	13	3	1.93	272.5	310.4
4	Standard emulsion—3 qts. + 1.25 gals. Blandol	30	5	4.00	251.0	285.9
5	Standard emulsion—3 qts. + 2.5 gals. Blandol	43	6	4.06	230.9	263.0
6	Standard emulsion—2 qts. + 2.5 gals. Blandol	22	5	4.13	221.1	251.9
7	Standard emulison—4 qts. + 2.5 gals. Blandol	61	8	4.87	234.0	266.6
8	Standard emulsion—3 qts. + 2.5 gals. Helix Sup.	28	6	5.40	228.8	260.6
9	Standard emulsion—3 qts. + mix of Helix and Hort. Base Oil	29	10	4.47	238.2	271.3
10	Standard emulsion—3 qts. + Hort. base—2.5 gals.	15	4	3.73	250.4	285.2
11	Standard emulsion—3 qts. + Texaco Corvus—2.5 gals.	31	6	4.67	241.5	275.0
12	Sonneborn emulsifier "A"—3 qts. + Blandol—2.5 gals.	40	12	4.80	233.5	265.9
13	Sonneborn emulsifier "B"—3 qts. + Blandol—2.50 gals.	71	4	4.80	230.6	262.7
14	Propylene Dichloride Solvent—3 qts. + Blandol—2.5 gals.	60	15	5.27	236.0	268.8
	(19:1)	15	7		25.3	
Diff. req. for sign	(99:1)	20	9		——	

* Dust applied every other day during silking at rate of 35 pounds per acre with rotary-type hand duster. Nine dust treatments made. Sprays were applied with compression-type knapsack sprayer at 50-60 pounds pressure and a Spraying Systems 9502 teejet nozzle, delivering a fan spray with a 95-degree angle. Nozzle directed in silk zone from each side of row as operator walked to deliver 50 gallons of spray per acre. Four spray treatments made on May 18, 21, 24, and 28.

**Average of three scorers. 0—green; 10—yellow.

tained in this experiment. Attention is called to the fact that the corn earworm infestation was extremely heavy. This is the first time that the DDT dust treatment has contained 100 percent wormy ears. The following number of eggs were found during a partial silk examination on the dates shown. The egg counts represent less than 50 percent of the total, since, in order to conserve time, only a partial examination was made with very little handling of silks to expose the eggs to view.

Date	No. of Eggs per 100 Silks
May 18	85
May 21	59
May 24	298
May 28	187

DISCUSSION OF RESULTS.—The 5-percent DDT dust treatment was a total failure in this trial. While there could be some other factors responsible for this failure, past experiments have shown that DDT dust will not control extremely heavy populations of earworms. All of the spray formulations were superior to the dust and the untreated check. The addition of Blandol to the DDT emulsion increased the control. Treatment with four quarts of DDT emulsion per acre per treatment was superior to three quarts, and the three-quart treatment was superior to two in corn earworm control. The type and amount of mineral oil influenced the control obtained. The use of propylene dichloride in place of xylene as the solvent for DDT increased the control about 40%. The use of Sonneborn Sons, Inc., Emulsifier "B" (15%) in place of Triton X-155 (5%) in the DDT emulsion increased the control about 65%. The large increase in worm-free ears, due in one case to the emulsifier and in another to the solvent, indicates good possibilities in vastly improving the corn earworm formulation through further studies with various emulsifiers and solvents.

Based on observations of unfilled ear tips it appears that some of the spray formulas are causing some damage to pollination. Formulas containing propylene dichloride, Emulsifier "A", or a mixture of Shell's Helix Superior and Shell Hort. Base No. 7 oils gave larger numbers of ears with more than 1½ inches of the tips undeveloped.

All of the sprays containing oil caused slight to moderate yellowing of the plants, as shown in the scores listed in Table 2. Unless this yellowing is associated with reduced yields it is not

excessive, because there are only slight differences in the ear husk color.

Differences between yields were significant at the 5%, but not the 1% point. The highest yield of corn with 6 inches or more in length was obtained with the DDT emulsion without oil. Other high yields included DDT dust, DDT emulsion plus Shell Hort. Base Oil No. 7, and DDT emulsion plus 1.25 gallons of Blandol. There is a strong indication that yields are being reduced by several of these spray formulations, and that yield reduction is due to the amount and type of oil used.

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CORN EARWORM CONTROL— SUMMARY AND RECOMMENDATIONS[1]

J. W. WILSON, WALTER H. THAMES, and NORMAN C. HAYSLIP

SUMMARY

I—SPRAYING METHODS.—Two experiments at Sanford, Florida, one on Ioana and the second on Calumet Sweet Corn, were conducted for the purpose of determining the most efficient methods in applying sprays for control of the corn earworm. Using a high clearance power sprayer and a standard DDT-mineral oil spray, the following factors were studied: (1) amount of liquid spray per acre, (2) kind of spray nozzles, (3) number of nozzles per row, and (4) operating pressure.

The data obtained show that nozzles should not be of a type which breaks the liquid into very fine droplets, the coarser sprays being more effective in depositing the insecticide on the silks. Wide angle nozzles, producing either hollow cone or fan spray patterns, are desirable from the standpoint of improving coverage. Four and five nozzles per row were superior to two and three, and in one of the tests five nozzles were superior to four. Pressure differences were not significant in the amount of control obtained, indicating that pressures as low as 60 pounds per square inch would be satisfactory.

In the Ioana planting the plots sprayed with the DDT-mineral oil formulation were noticeably yellow in color when compared with the untreated plots. This difference did not appear in the Calumet planting. Total yield figures for both varieties of corn did not indicate a yield reduction due to the effects of the DDT-oil spray.

II—TIME, INTERVAL AND NUMBER OF APPLICATIONS.—Ioana sweet corn was used for a detailed experiment at Belle Glade, Florida, in May, 1951. Factors under study included (1) the number of spray applications, (2) the interval between applications, and (3) the time of beginning and discontinuing treatments. A uniform DDT-minreal oil emulsion was applied with a knapsack type compression sprayer fitted with a pressure gage and a 65 degree Teejet fishtail nozzle. Two 5% DDT dust schedules were included for comparison with the spray. A rotary hand duster was used for applying the dust.

[1] Florida Agricultural Experiment Station Journal Series, No. 59.

The corn earworm population was moderately heavy, as indicated by egg counts and the untreated check plots. The data show a definite interaction between the three factors investigated. Many of the spray treatments were far superior to the two dust treatments. From the information obtained in this experiment it appears that daily spray applications are not justified. Where 5 or 6 applications were made, the two-day interval between treatments was more effective; however, with 3 or 4 applications, the three-day interval was more satisfactory. There was evidence that the sprays should be applied over a period of at least 12 to 14 days.

III—FORMULATIONS.—An experiment on Ioana sweet corn at Fort Pierce, Florida, during a severe corn earworm infestation was conducted for the purpose of investigating several DDT spray formulations. Factors included (1) the amount of 25 percent DDT emulsion per acre, (2) the amount and types of mineral oil, (3) the effect of three emulsifiers and two solvents, and (4) a comparison between DDT dust and the spray formulations.

In a comparison of 2, 3 and 4 quarts of 25% DDT emulsion per acre with 2.5 gallons of Blandol, the amount of control increased with an increase in the dosage, giving 22, 43 and 61% worm-free ears, respectively. Treatments of DDT emulsion, DDT emulsion plus 1.2 gallons of Blandol and DDT emulsion plus 2.5 gallons of Blandol showed that the addition of this mineral oil increased the control, giving 13, 30 and 43% worm-free ears respectively. However, there was some indication that the mineral oil reduced the yield. One type of oil gave no increase in control above the DDT emulsion wthout oil. There was evidence that low viscosity oils were inferior to oils of intermediate viscosity. One formulation containing Sonneborn Sons "Emulsifier B" produced 71% worm-free ears, as compared to 40% with this Company's "Emulsifier A" and 43% with Rohm and Haas's "Triton X-155". Propylene dichloride solvent gave 60% worm-free ears, as compared with 43% for xylene. The use of propylene dichloride resulted in some pollination injury. All of the sprays containing oils caused some yellowing of the plants.

A laboratory preparation of DDT emulsions was used in all of the experiments reported on in these papers. For the purpose of this coordinated study it was desirable to use a uniform emulsion of known composition.

RECOMMENDATIONS

I—SPRAYING METHODS.—A high clearance power sprayer with adjustible boom and nozzles, a good agitator and an efficient strainer is suggested for large acreages. The construction of the sprayer and the preparation of the soil should be such as to eliminate verticle and horizontal fluctuations of the spray nozzles. Rough and irregular rows make efficient spraying impossible, and loose or swinging booms and drop pipes seriously decrease the uniformity of coverage. Since the sprayer may be used for budworm and disease control, the pump and spray tank capacity should be adequate to deliver up to 150 gallons of liquid per acre.

Four wide angle hollow cone or fan type nozzles per row are suggested. Nozzles and pump pressure which produce a rather coarse spray should be selected. The proper placement of these nozzles will give adequate coverage for the corn earworms on the silks. Drop pipes should be centered between rows, with two pairs of nozzles attached to spray into the side of each row. The higher pair of nozzles should be well above the general silking zone, and directed downward to spray into the ear tips. The second pair of nozzles should be 9 to 12 inches below the higher pair, and directed to spray into the sides of the ears. Place both pairs of nozzles slightly high in order to take care of fluctuations in corn heights within the field. The best spray pressure will vary with the type of nozzles used. Some will work satisfactorily at low pressures.

These remarks on spraying methods are intended as a guide only; there is no substitute for following behind the sprayer to see if it is thoroughly wetting all ears and silks.

II—TIME, INTERVAL AND NUMBER OF SPRAY APPLICATIONS.—Since the time of beginning and discontinuing treatments, the interval between treatments, and the number of treatments are interrelated, any recommendation must be based upon all three factors. The fluctuations in the time of maximum egg deposition from crop to crop, and the silking variations between varieties and between different plantings of the same variety further complicate the issuance of a general recommendation.

It seems most desirable, therefore, to make suggestions aimed at giving the maximum amount of protection over as long a period as is practical and safe. Four to five applications at three-day intervals are suggested. The first treatment should be made on the day the first silks appear, or when about one percent of the silks are showing. It is suggested that budworm

sprays continue until the earworm sprays are begun in order to prevent migration of worms from the tassels, leaves and stalks into the ear tips before the silks appear. If corn-silk flies are present when the tassels begin to show, a treatment of parathion or chlordane is suggested.

III—FORMULATIONS.—Due to the variations in formulations of commercial DDT emulsion concentrates, it is not possible to recommend simply 25% DDT emulsion mixed with white mineral oil. Some of the commercial products may be satisfactory while others would not, depending upon the type and amount of the emulsifier and solvent. Since it is not generally the practice of chemical companies to supply complete formulation data on their emulsion concentrates, tests of various commercial products would not add to the needed information on emulsifiers and solvents.

Investigations on the amount and types of insecticides, emulsifiers, solvents and mineral oils going into the corn earworm formula have resulted in some interesting leads; however, this formulation work is not complete enough to make a recommendation at this time. It can be stated that xylene (70%), Triton X-155 (5%), and technical DDT (25%) by weight in each case has been used satisfactorily and has caused no noticeable injury to the plants. This emulsion, however, when mixed with mineral oil and diluted with water makes a very unstable mixture requiring vigorous agitation. The most recent experiment on formulations indicates that Sonneborn's "Emulsifier B" may be superior to "Triton X-155" and it gives better control and results in a more satisfactory emulsion when mixed with white mineral oil and diluted with water. Propylene dichloride solvent was superior to xylene in worm control, but caused some pollination damage. The addition of mineral oil increased the control, but in some cases it has caused reduced yields. After taking the above statements into consideration, the following suggestions are presented.

(1) When DDT dusts are producing a high percentage of worm-free ears (80 to 100%), it usually means that the corn is growing during relatively low populations of adult earworm moths, and it is suggested that DDT dusts may be continued, since they are satisfactory under light infestations. Low populations have occurred most often during the Fall and early Spring. Apply 35 pounds per acre of 5% DDT dust every other day, beginning when the first silks appear, and discontinuing when the silks turn brown.

(2) For moderate corn earworm infestations, where dusts normally produce 60 to 80% worm-free ears, a spray delivering 3 to 4 quarts of 25% DDT emulsion per acre per treatment is suggested. Attention is called to the fact that some emulsions may cause injury at these high rates of application. Apply the DDT emulsion in about 50 gallons of water per acre.

(3) For severe infestations, where neither dusts nor sprays with DDT emulsion are expected to produce the desired results, it is suggested that four quarts of 25% DDT emulsion be mixed with 2.5 gallons of highly refined white mineral oil (80 to 95 viscosity) and then mixed with 50 gallons of water, applying this amount to one acre. It is pointed out that some yield reduction may occur with this formulation; however, if the corn is healthy and vigorous before treatments begin, the reduction should be slight, provided the DDT emulsion used has been previously tested for this purpose and found to be non-phytotoxic.

Most growers would prefer a slight yield reduction to the worms. If examinations are made for eggs on the stalks and husks before silking and on the very first silks, this should act as a guide in determining the degree of infestation. Since this is generally too late to begin treatments, it would serve only to indicate what to expect on younger plantings. If a few rows of corn were seeded 4 to 5 days before the main planting was made these rows could be used for determining the degree of the infestation in time to begin treatments. This method would not be infallible, but should prove beneficial in many instances.

A COMPARISON BETWEEN GRAPE DEGENERATION IN FLORIDA AND PIERCE'S DISEASE IN CALIFORNIA

WARREN N. STONER[1]

Early Spanish settlers in the 16th century became familiar with the native Florida grapes. The wild grape plants grew profusely, and, because of this, they made plantings of the European grape, *Vitis vinifera* L., that they knew so well. These plantings failed and, by and large, one might say this has remained the history of the European grape in Florida to this day.

Many attempts to grow grapes on a commercial basis in Florida have been made since these early times. DePass in 1891 had 60 varieties on trial near Lake City. They all soon failed. Varieties of the species *Vitis labrusca* L. were also tried at this time, but they did little better and were soon gone. By 1894 a considerable grape industry had been built up in the state and perhaps more than a thousand acres of grapes, mostly the variety White Niagara, were planted. It must have indeed seemed at this time that viticulture was at last established in Florida. However, these plantings began to fail and in less than a decade were gone. This period closely coincides with the time that a "condition" called California vine disease, mysterious vine disease, or Anaheim disease was killing thousands of acres of grapes in southern California.

The grape growers in Florida were able to interest the Federal Government in their problem in 1899 and grape tests were started at Earlton, Florida. These tests were being made by Baron van Luttichau almost concurrently with those of Pierce in California, who was attempting to solve the problem of California vine disease there. The Florida plantings of Luttichau failed but they did indicate that certain rootstocks were beneficial, and that the Munson Texas Hybrids were of some value here. By this time Pierce had made extensive studies of the California vine disease problem and reached the conclusion that the condition in California was not due to soil types, or cultural practices. He also believed the vine disease was not being caused by a fungus or bacteria but was due to some obscure contagious disease producing agent that was spreading through the vineyards. By 1900 the incidence of California vine disease, which

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we now call Pierce's disease, had increased sharply and while we now know the disease was present it was more or less static for several years (until about 1935). Hewitt (4) in 1939 showed that Pierce's disease was caused by a virus.

Hawkins, in 1924, planted almost one hundred varieties of European grapes at Eustis, Florida, on land where the grape phylloxera, *Phylloxera vitifoliae* (Fitch), was known to be absent. The planting was not successful and was abandoned. By this time however, a resurgence of grape culture in Florida had occurred and commercial crops of the Munson Texas Hybrid grapes such as Extra, Carman, R. W. Munson, Muench and Bailey were being produced and shipped to northern markets in carload lots.

The fresh grape industry decreased in Florida during the thirties and little replanting was done. The vineyards declined and grape culture in the state waned again.

By 1946 Stover had reason to believe, from wide experience and observation, that a limited number of grape varieties of *V. labrusca* parentage could be grown if grafted to suitable rootstocks. Dickey, Stover and Parris (1) made definite recommendations in 1947 on varieties and rootstocks. Since that time these combinations have not proven up to expectations and Parris (6) in 1951 stated, "We therefore have no grape variety or combination of varieties in a grafted plant which we can recommend for planting in Florida at the present time."

At this point it would seem that the viticulturist in Florida has once more completed the cycle of promise then failure. Again, let us re-examine the known facts of grape degeneration in Florida in comparison to what is known of Pierce's disease of grape in California.

Pierce's disease has been proven to be due to a virus (4) and several insect vectors are known (3, 8, 9). The syndrome has seasonal variations, and varietal responses differ. The disease has in the past indicated a cyclic tendency (12). Extensive field, greenhouse, and laboratory investigations have replaced speculation and pointed the way to a commercial control of the disease in California.

The occurrence of the symptoms of Pierce's disease in a given plant will depend to a certain extent upon when that plant is infected, its state of growth and the variety. Let us take a hypothetical situation for a discussion of the symptoms and presume we have a healthy plant of a susceptible European

grape, *V. vinifera*, that would show the full range of symptoms. We will also assume this plant is inoculated with Pierce's disease virus in the late summer or early autumn. During the remainder of that growing season probably no discernable differences will be noted. The fruit that has set will probably reach maturity and the vine will go into an apparently normal dormancy that winter. The following spring little or nothing may be detected to indicate early the vine is diseased, except that it is slow to start. After two or three weeks growth this vine would appear to be lagging behind the others. (This delayed growth has often been supposedly due to insufficient chilling or "faulty dormancy".) The next difference to be noted would be that one arm of the vine apparently catches up and seems normal while the canes of the other arm are shorter because the internodes are reduced in length. The basal or first leaves of these canes may then show interveinal mottling. This mottling then appears progressively in successive leaves toward the tip. (Irregular dormancy, fertilizer deficiencies, root damage, certain insects and arthropods, and irrigation practices have been thought in the past to cause this.) By the time the early flush of spring growth has slowed, a marginal burn may begin to show on the basal leaves and an occasional cane may suddenly wilt and dry up. (This has been attributed to such factors as sunburn, high temperatures, insect attack, drought and sulfur burn in the past.) During this first season after infection, a fair set of fruit may occur, but a few bunches may shell early and the fruit stems can be seen on the vines all through the year. (This has been blamed on poor pollination, disease, heavy fruit load and other causes.)

As the summer progresses leaf scorching becomes more severe and interveinal chlorosis may be more distinct. Bunches of green fruit that have appeared normal become flacid and withered, color prematurely, and are insipid in flavor. (Again drought, mechanical damage, disease, heavy fruit load, etc., have been blamed for water berry or withered fruit.) By mid-summer many canes on both arms of the plant may have shed their leaves but in an abnormal manner. Instead of the leaf petiole abscissing from the cane the leaf laminae absciss from the petioles and the petioles remain on the canes. (This opens the vine and sunburn occurs on the unprotected fruit.)

After harvest in the autumn when the vine is again returning to dormancy a very definitive symptom of Pierce's dis-

ease can be seen. Canes instead of turning a normal tan or brown will have green areas persisting between the nodes and in some cases these areas will be slightly raised above the surface of the brown areas. (Occasionally one may note a size differential in the diameter of the pruned arms at this time, but this is not a reliable symptom.)

While the top of the plant is showing these symptoms changes are also taking place in the roots. At first the small feeder roots die back from the tips and become necrotic. In this weakened condition the roots are often invaded by secondary organisms, and the thrift of the vine again suffers. In each succeeding season there is greater root death. (Before the viral nature of the primary pathogen was known the disease was often attributed to these secondary root invaders.)

The grape phylloxera, *Phylloxera vitifolae* (Fitch) is frequently found on the roots of vines suffering with Pierce's disease, and for many years the damage caused by the activities of this insect were believed by some to cause the "condition". This insect has been implicated in like circumstances with grape degeneration in Florida, but has never been actually proven the cause.

The following spring the same pattern will start again with increased severity, and often the arm that was weak before will fail to produce any growth or will have only short weak suckers at the base. The other arm will behave much like the weaker one did in the previous season, and while the vine may live on the second year little or no fruit will be produced and death will soon follow.

An idealized description of the symptoms of grape degeneration in Florida would be very much the same as the foregoing of Pierce's disease in California. From a syndrome stand-point the patterns of the two are remarkably similar if not identical.

If one combines certain of the symptoms described by Rhoads (7) in 1926, under root rot, (which he lists as being caused by the fungus *Clitocybe tabescens* [Scop. ex Fr.] Bres.) non-setting of fruit, shelling of fruit, chlorosis, and irregular water relations, (all listed under injuries due to physiological causes) one has a good description of grape degeneration, or Pierce's disease.

Not all of these symptoms are manifested in every vine suffering from Pierce's disease or grape degeneration, but many different varietal and species reactions are known for Pierce's disease (5). These differential reactions also occur in Florida

in a like manner in respect to grape degeneration and are consistent with those known for Pierce's disease in California (10).

Now let us consider transmission of Pierce's disease virus. Frazier and Freitag (3) have shown the close relationship between the 14 species of leafhoppers known to be capable of transmitting the virus. Severin (9) has reported four species and five varieties of spittle bugs also have this ability. Pierce's disease virus is a persistent type virus as Watson and Roberts (11) define this group. This more or less limits field spread to insect vectors and inadvertent inoculation in propagation activities. In the list of insects known to transmit the virus three are believed to be responsible for most of the field spread in California. These are: the blue-green sharpshooter, *Neokolla circellata* (Baker), the green sharpshooter, *Draeculacephala minerva* Ball, and the redheaded sharpshooter *Carneocephala fulgida* Nott. The redheaded sharpshooter *Carneocephala fulgida* Nott. favors bermuda grass, *Cynodon dactylon* (L.) Pers. as a host plant and Winkler (12) includes this grass as one of the hosts of Pierce's disease.

Many investigators have observed that when bermuda grass invades the vineyards in Florida the vines die out very quickly from degeneration. This observation led the author to make sweep collections on bermuda grass in several localities near Leesburg on June 5 and 6, July 10 and 11 and August 20 and 23 of this year. Large numbers of the yellowhead sharpshooter *Carneocephala flaviceps* (Riley)[2] were taken on bermuda grass in locations where degeneration had eliminated grapes or was quite evident in the vineyards. A few individuals of the species *Draeculacephala portola* Ball and *Draeculacephala inscripta* Van Duzee were also taken on grasses adjacent to a grape nursery where there was a high incidence of grape degeneration. None of these species are proven vectors of Pierce's disease but they are closely related to two of its principal known vector species in California, and as Frazier and Freitag have pointed out (3) should be suspected as vectors because of this relationship.

Observations in Florida areas where grape degeneration has been severe in the past show that several species of plants known to be hosts of Pierce's disease virus in California are present. This is especially true of certain grasses and both wild and cultivated legumes.

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[2] The author is indebted to Professor Dwight M. DeLong of Ohio State University, Columbus, Ohio, for determination of these specimens.

Hairy indigo, *Indigofera hirusta* L., and lupine, *Lupinus angustifolia* L., purposely planted as crops in areas where grape degeneration has occurred, have been observed showing dwarfing and witches broom symptoms. While there is no controlled proof that these species are infected with a virus when these symptoms are present the inference is plain. (Pierce's disease virus also causes serious loss in California in alfalfa plantings. The disease in this host is called Dwarf or Witches Broom.)

Esau (2) has shown that infection with Pierce's disease virus can cause the formation of tyloses and the deposition of gum in the xylem elements of the grape. Specimens of grapes suffering from grape degeneration were taken from the field near Leesburg on June 5, 6, and 19th of this year. Fresh sections were made and microscopically examined. Large numbers of tyloses and heavy gum deposition was found in the xylem elements of these Florida specimens.

What can be said in summary then of the comparison between grape degeneration in Florida and Pierce's disease in California.

1. Past history of both are almost concident chronologically.
2. External field symptoms of both are strikingly similar if not identical.
3. Species of sharpshooters closely related to known vectors of Pierce's disease virus occur in Florida where grape degeneration has long been a problem.
4. Plants proven to be hosts of Pierce's disease virus and its vectors are abundant where degeneration occurs and exhibits symptoms typical of Pierce's disease virus infection.
5. Preliminary laboratory studies show that aberrations in the internal anatomy of grapes suffering from grape degeneration in Florida are similar to those induced by infection with Pierce's disease virus in the same host in California.

The overall field ecologies of Pierce's disease and grape degeneration are much too similar to be reasonably ascribed to coincidence. This ecology as set forth in this paper strongly indicates that what has been called grape degeneration in Florida is actually Pierce's disease. Insect vector trials, insect vector field infectivity trials, insect vector location studies, insect vector life history investigations, host range determinations for both insect vectors and the suspected virus, and grafting experiments are now being conducted to test this hypothesis.

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A NEGLECTED PAPER BY A. L. MONTANDON ON CRYPTOCERATE HEMIPTERA

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Subsequent writers have very generally overlooked an important paper by A. L. Montandon published in 1910. Its one new species has not been noticed in the Zoological Record; no references to it occur in Van Duzee's Catalogue (1917); and the only citation to it I have seen was by Jaczewski (1934) under *Ochterus marginatus*. It is entitled "Quelques types d'Hémiptères de Guérin-Méneville des Collections du Musée Zoologique de l'Université de Naples", and appeared in the *Annuario del Museo Zoologico della R. Università di Napoli (Nuova Serie)*, Vol. 3, No. 10, pp. 1-4, February 21, 1910. I am indebted to the Librarian of the Museum of Comparative Zoology of Harvard University for the information that this is the correct pagination and not merely the pagination of a reprint.

In this paper Montandon reported his studies on the Guérin types of cryptocerate Hemiptera in the Naples Museum. Some older synonymy was confirmed; some new synonymy was stated; and *Gelastocoris major* n. sp., was described on page 2 to replace *G. flavus* (nec Guérin) as formerly misidentified both by Montandon and by Champion. I may add here that we must place *Gelastocoris andinus* Melin 1928 as a *new synonym* of *G. major* Mont., since it too was proposed to replace *G. flavus* Champ. 1901 nec Guérin.

Certain of the synonymy proposed by Montandon in 1910 is quite different from that found in the writings of more recent authors who have not had the benefit of examining Guérin's types. It seems desirable, therefore, to give the following resumé of this paper. In this abstract new synonymy stated in the 1910 paper is indicated by asterisks (*); and any comments I have added are inclosed in square brackets.

[Page 1.] Pelogonus Perbosci Guérin 1843; Campeche, Mexico. Very near *P. americanus* Uhler, if not identical. When these species are better known, they may prove not to be separable from the Old-World P. marginatus Latr. [Opinion expressed by Montandon.]

Pelogonus marginatus Latr. 1807 = *P. indicus* Guérin 1843. [Confirmation of Montandon's 1897 statement of their probable identity.]

[Page 2.] Gelastocoris variegatus Guérin 1843; Campeche. A species

easily recognized by the crenulated lateral margins of the pronotum and embolium, the latter square-cut at its apex.

GELASTOCORIS NEBULOSUS Guérin 1843 = *G. flavus* Guérin 1843. The type of the former is a male, of the latter a female. This is not the species formerly identified as *flavus* by Montandon and Champion. [Stål published this identical synonymy in 1876, *Enum. Hem.* 5: 137. However, in the *Iconographie* 3: 351, Guérin described *Galgulus flavus* first, *G. quadrimaculatus* second, and *G. nebulosus* third, so that *flavus* has page priority over *nebulosus*.]

GELASTOCORIS MAJOR n. sp. = **G. flavus* (nec Guérin) Montandon olim, Champion 1901, B.C.A.Het. 2: 349. [= *Gelastocoris andinus* Melin 1928, *Zool. Bidr. Uppsala* 12: 159, as stated above.] Differs from *G. nebulosus* in having the lateral pronotal margins more broadly dilated posteriorly, very feebly bisinuate anteriorily, the lateral angle of the dilatation rectangular, hardly obtuse, not crenulated as in *G. variegatus*, not rounded, the anterior margin of this angle very oblique (not transverse as in *G. nebulosus*), the posterior margin of the angle truncate, not rounded, so that the pronotum is narrower than the elytra; embolium very obtusely angled at its apex, almost rounded. This species is usually a little more robust than the other known forms [of the genus], and of a more uniform grayish color. [The pronotal structure of *nebulosus* = *flavus* as described by Montandon from Guérin's types does not agree with that of the form identified and figured as *flavus* by Martin, 1928, *Univ. Kansas Sci. Bul.* 18(4): Pl. 48, fig. 18.]

GELASTOCORIS QUADRIMACULATUS Guérin 1843 = **G. vicinus* Champ. 1901, op.cit. p. 349; Montandon inedit. Guérin's type is labelled "Bolivie", a locality which Montandon questions. Its coloration differs from that of other specimens that Montandon had labelled *G. vicinus*, the pronotal lateral margins being wholly and widely pale yellowish, and each corium having a large pale yellow spot near its apex. It agrees in form with those other specimens, whose range extended from Costa Rica to Brasil and Bolivia.

MONONYX FUSCIPES Guérin 1843; Colombia. The unique male type agrees with the description of the species given by Montandon in 1899, *Bull. Soc. Sci. Bucarest* 8(4-5): 400.

MONONYX LATICOLLIS Guérin 1843; New Guinea. The type is a large male, 10.5 mm. long, agreeing with Montandon's description, 1899, op. cit. 407.

[Page 3.] PELTOPTERUS Guérin 1843, type *Naucoris rugosa* Desjard. 1837, = *Scylaecus* Stål 1861 [type *Galgulus macrothorax* Montrouz.], as stated by Montandon in 1900, *Bull. Soc. Sci. Bucarest* [8:] 779-780.

LACCOTREPHES GRISEUS Guérin (*Nepa*); Bengal. Occurs also in Burma, Malay Peninsula, Ceylon, Madras, Pondicherry, etc. Distant (1906, *Rhynch. Brit. Ind.* 3: 19) was wrong in synonymizing this species with *L. maculatus* Fabr., from which it is separable by the strong acute tubercle on the prosternum anteriorly (absent in *maculatus*), the longer appendages, and the more obtusely rounded basal tooth on the fore femora.

RANATRA FABRICII Guérin 1856 = *R. annulipes* Stål. The Naples Museum has two specimens (♂ and ♀) of this species, easily recognizable

by the form of the metasternum as already noticed by Montandon (1905, *Bull. Soc. Sci. Bucarest* 14: 393). [In my copy Montandon corrected this to read: *R. annulipes* Stål 1854 = *R. Fabricii* Guérin. This synonymy may not be correct, since Montandon has recently been shown to have confused several species under the name *annulipes* Stål: see De Carlo, 1950, *Rev. Brasil. Biol.* 10(4): 526-528.]

BENACUS GRISEUS Say 1831 = *Betostomo* [sic] *angustata* Guérin 1856 in Sagra. [No comment on any specimens in the Naples Museum. This synonymy dates from Mayr, 1871, *Verh. zool.-bot. Ges. Wien* 21: 428, who used the name *haldemanus* Leidy in place of *griseus* Say.]

LETHOCERUS ANNULIPES H.-S. = **Belostoma curtum* Guérin 1856 = **Belostoma medium* Guérin 1856 = *Belostoma caudatum* Percheron, inedit., cited by Guérin, 1856, in Sagra. One of the Guérin types in the Naples Museum is labelled "*Belostoma latum* Guér. Type." This is an unpublished name, almost certainly a lapsus calami for *B. curtum*. [In all probability *curtum, medium* and *caudatum* should be synonymized with *L. del pontei* De Carlo 1930, *Rev. Soc. Ent. Arg.* No. 13, p. 108, which Montandon and others mis-identified as *annulipes*, nec Herrich-Schaeffer.]

[Page 4.] AMORGIUS COLOSSICUS Stål = **Belostoma grande* Guérin 1856 in Sagra, nec Linné. [No comment is given on any specimens in the Naples Museum.]

HYDROCIRIUS COLOMBIAE Spin. 1852 = *Belostoma capitata* Guérin in Sagra 1856. [No further comment by Montandon. This synonymy was first stated by Mayr, 1865, *Reise der Novara, Hem.*, p. 183, and repeated by him in 1871, *Verh. zool.-bot. Ges. Wien* 21: 429. The occurrence of the African *H. colombiae* in the Americas is most doubtful; and *B. capitatum* Guérin is synonymized with *Lethocerus annulipes* H.S. 1846 by De Carlo, 1938, *Anal. Mus. Arg. Cienc. Nat.* 39: 201.]

PELOCORIS FEMORATUS Pal. de B. 1805 = **Naucoris Poeyi* Guérin in Sagra, 1856. [No comment by Montandon on specimens in the Naples Museum.]

CONCERNING AMERICAN OCHTERIDAE (HEMIPTERA)

CARL J. DRAKE

The family Ochteridae is a very small family of littoral Hemiptera divided among two genera. The genus *Megochterus* Jaczewski is not represented in the American fauna and is known only from the Australian region. Although most of the species are found in the tropics, the genus *Ochterus* Latreille is widely distributed in the temperate and torrid regions of both hemispheres.

The species of the genus *Ochterus* are brownish or black in color and moderately large. As they are unusually uniform in general appearance, it is often necessary to remove the male capsule so as to study the right paramere for specific determination. A few species such as *O. flaviclarus* Barber and *O. acutangulus* (Champion) have color markings and structural characters that set them apart from their congeners. *O. perbosci* (Guerin) is probably our most widely disseminated species, ranging from southern Texas and Arizona south deep into Brasil and Peru. It is also widely distributed in the West Indies. *O. americana* (Uhler) is the commonest and most widely dispersed species in the United States.

The genus *Ochterus* is represented in the New World by 16 species, including the new form described below. The American species are chiefly tropical or subtropical in distribution. They inhabit the wet, sandy, and muddy borders of streams and standing bodies of water. Their mobility and ability to survive submergence make them independent of wave action, flash floods, and seasonal variations in the shore line. Living conditions are more favorable when the wet space between the water's edge and low vegetation along the shore is not very wide. During wet and rainy days, the adults often wander some distance from the shore in quest of food. On account of their color, selective habitats, and especially their jumping or leaping and hiding characteristics when disturbed, they are rather difficult to collect and are poorly represented in collections.

Insofar as known, no species of *Ochterus* is limited to brackish coastal water or saline inland waters. Not enough field work has been done to ascertain if any species is intolerent to salt water. The writer found *O. perbosci* and *O. viridifrons* (Champion) inhabiting the shores of brackish lagoons and

marshes along the seacoasts in Panama and Mexico as well as semiaquatic fresh water habitats.

Ochterus schellae n. sp.

Ochterus acutangulus Schell (not Champion), *Jour. Kan. Ent. Soc.* 16(2): 38, pl. 1, fig. 4. 1943.

Brownish black with patches of bluish pruinose; head in front of ocelli metallic green and shining, behind ocelli blackish as pronotum. Pronotum with posterior margin narrowly yellowish brown, the acute humeral angles more brownish; explanate margins brownish with a large spot within next to calli pale testaceous. Hemelytra with the outer margins narrowly testaceous. Pubescence fleck-like, golden.

Length, 5.10-5.50 mm.; width, 2.75-3.00 mm.

Pronotum distinctly pitted, strongly narrowed anteriorly, much wider across humeral angles than median length (200:80), posteriorly margin strongly sinuate; explanate margins moderately wide, narrower behind, with humeral angles obtusely angulate and not acutely angulate as in *O. acutangulus* Champ., the outer margins nearly straight (feebly or indistinctly rounded); shallowly transversely impressed between lobes, the front lobe broadly impressed medially a little back of front margin.

Head above faintly impressed between eyes, transversely rugulose, with a faint median ridge. Rostrum, labrum and clypeus flavotestaceous. Antennae with the two basal segments moderately incrassate, testaceous or light fuscous, the other two rather slender and fuscous and nearly subequal (22:20), the fourth thickest just in front of middle and then tapering a little towards both ends.

Legs long, moderately stout, testaceous, sometimes a little darker on femora and tibiae, clothed with longer pale hairs beneath; tibiae armed with the usual dark spines; apex of tarsi darkened.

Type (male), *allotype* (female) and 4 *paratypes*, Tejupilco, Mex., alt. 1340 meters, June-July, 1933, H. E. Hilton. Type in my collection. Paratypes in collection of the University of Kansas. Named in honor of Mrs. Dorthydean Veitz Schell, who has given us the first critical study and monograph of the American Ochteridae.

This species was wrongly determined by Mrs. Schell (*Jour. Kan. Ent. Soc.*, 16 (2) :38, pl. 1, fig. 4, 1943) as *Ochterus acutangulus* (Champion). The male genital capsule and right paramere of *O. schellae* are nicely illustrated in the above Journal by Mrs. Schell. The right paramere is swollen apically and distinctly club-shaped.

Ochterus acutangulus (Champion) (Fig. 1)

Pelogonus acutangulus Champion, *Biol. Centr.-Amer., Rhynch.*, 2:364, pl. 20, figs. 15 & 15a, 1901.

O. schellae n. sp. has been wrongly determined in collection and the

literature as *O. acutangulus*. The latter has the humeral angles distinct acute and produced laterally a little beyond the margins of the hemelytra. The pronotum is also differently shaped as may be noted in the illustration, fig 1. A female from Cuba is figured.

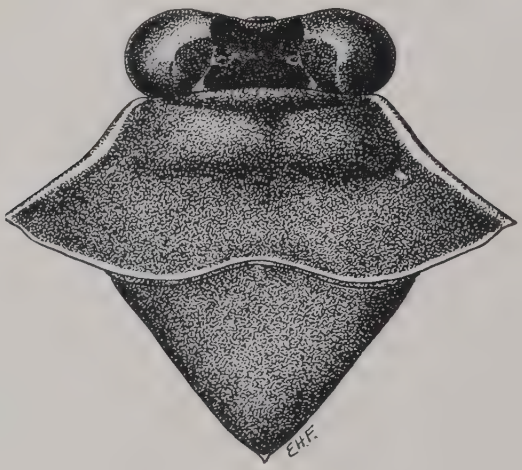


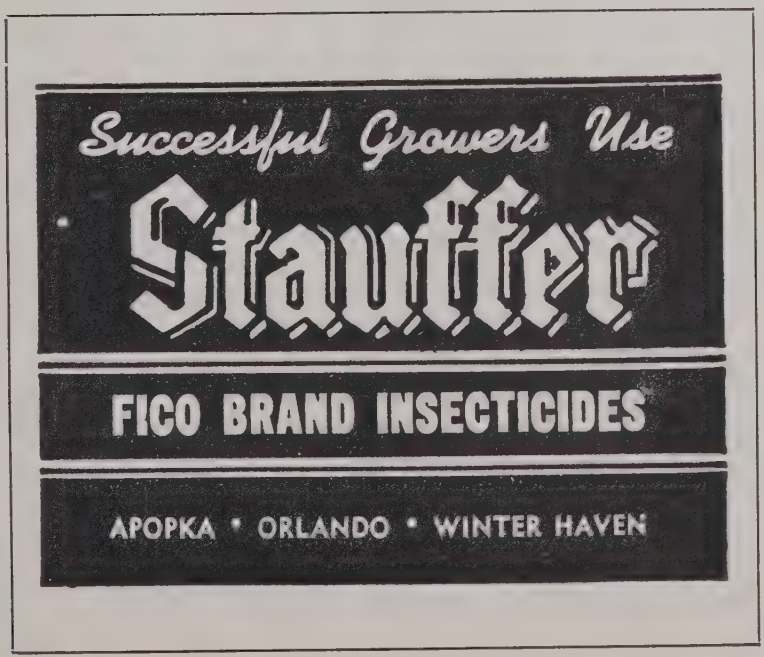
Fig. 1.—Pronotum of *O. acutangulus* (Champ.) (X28)

LIST OF AMERICAN SPECIES

Genus *Ochterus* Latreille, 1809
Pelogonus Latreille, 1809
Type, *O. marginatus* Latreille.

1.	*acutangulus* (Champion), 1901	Guat., Mex., Cuba.
2.	*aenifrons* (Champion), 1901 *marginatus* (Uhler), 1893	Mex., Centr.-Amer., W. I., Col., Venez.
3.	*americanus* (Uhler), 1875	Nebr., Ill., Iowa, N. Y., Md., Mass., Miss., Fla.
4.	*banksi* Barber, 1913	N. Y., Mass., N. J., Va. Fla., Miss.
5.	*barberi* Schell, 1943	Mex., U. S. (Ariz., N. Mex.)
6.	*bidentatus* Schell, 1943	Peru.
7.	*brunneus* Hungerford, 1927	Bol.
8.	*flaviclavus* Barber, 1913	Fla.
9.	*hungerfordi* Schell, 1943	Cuba.
10.	*manni* Hungerford, 1927	Bol.
11.	*parvus* Schell, 1943	Ecuador.

12.	*perbosci* (Guerin), 1843	Mex., Centr.-Amer., Col.,
	marginatus (Uhler), 1893	Peru, U. S. (Ariz., Tex.).
13.	*schellae* Drake, 1952	Mex.
	acutangulus Schell, 1943	
14.	*spendilulus* Montandon, 1898	Ecuador.
15.	*victors* (Boliver), 1879	Ecuador.
16.	*viridifrons* (Champion), 1901	Centr,-Amer., W. I. Mex., U. S. (Ariz.).



ANNOUNCEMENT OF ANNUAL MEETING OF THE FLORIDA ENTOMOLOGICAL SOCIETY

Following the suggestion of Mr. Norman Hayslip, Chairman of the Committee on Arrangements, the Executive Committee has selected Fort Pierce, September 25 and 26, as the place and dates for the annual meeting of the Florida Entomological Society. Mr. Hayslip has assured the Executive Committee that the Fort Pierce Hotel has excellent facilities for entertaining members of the Society at reasonable rates. The meeting will be held in the Community Center Building across the street from the hotel. Restaurants are also available near the hotel.

Dr. D. O. Wolfenbarger, Subtropical Experiment Station, Homestead, has accepted Chairmanship of the Program Committee. He has already arranged with several outstanding men to present invitation papers. Members of the Society who plan to present papers are asked to give Dr. Wolfenbarger the title of the paper and the type of projection equipment required for illustrative purposes on or before August 1. Due to the number of papers which will probably be presented, time for each paper will be limited to fifteen minutes. An effort is being made to arrange the program in sections similar to the arrangement used last year.

An entertainment committee has been appointed and arrangements for the meeting are taking shape. One feature of the program will be a banquet (reasonable per plate cost) with Mr. W. W. Yothers as the principal speaker. Mr. Yothers has selected as his subject: "Some Forgotten Instances of Biological Control of Insects Attacking Citrus Trees".

The effort being expended by all who have been asked to assist in planning assures an excellent meeting. Individual members can materially assist in preparing the program by submitting to Dr. Wolfenbarger, titles of papers they plan to present, by August 1. Cooperation in this matter will make an early printing of the program possible.

J. W. WILSON
President

ITEMS OF INTEREST

Mr. W. B. Gresham, Jr., Entomologist, Professional Exterminators, Tampa, writes that his organization has discovered a tropical roach not heretofore known to be established in the United States. The roach was identified as *Nauphoeta cinerea* (Oliv.) by Dr. A. B. Gurney, Orthopterist, U. S. Bureau of Entomology and Plant Quarantine, Washington. Mr. Gresham quotes from a letter written to him by Mr. C. F. W. Muesebeck, Director of the Division of Insect Identification, "We seem to have no definite records of the establishment of *Nauphoeta cinerea* in the United States although it has often been taken at ports of entry on products and materials coming from the South. We should be interested to know if your observations indicate definite establishment in the Tampa area."

Mr. Gresham further reports that the roach is well established in several locations in Tampa, especially in the feed manufacturing mills. He is conducting studies on the species and has now established a colony in his laboratory.

The Society of Systematic Zoology has initiated publication of a new quarterly journal, SYSTEMATIC ZOOLOGY. The first number appeared in April. Articles of general interest to all zoological systematists will occupy most of the space in the journal. Book notices, news items, projects, people, museum activities, lists of systematic societies, and other miscellany will round out the contents.

The new serial has three purposes: "(1) to publish, and therefore to encourage the preparation of, contributions on basic aspects of all fields of systematic principles and problems; (2) to provide a suitable forum for discussion of the problems of the systematist and his methods; and (3) to report the other activities of the Society of Systematic Zoology as news."

Correspondence regarding subscriptions and membership should be addressed to the secretary of the Society, Dr. R. E. Blackwelder, Room 429, United States National Museum, Washington 25, D. C.

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